WHAT IS CLAIMED IS:

1. A photovoltaic conversion device, comprising abutting layers of p-doped diamond and n-doped ultrananocrystalline diamond, whereby irradiation of at least one of said diamond layers produces electron flow between said layers.

2. The photovoltaic device of claim 1, wherein said p-doped diamond is microcrystalline diamond.

3. The photovoltaic device of claim 1, wherein said p-doped diamond is microcrystalline diamond with average grain size in the range of from about 1 micron to about 10 microns.

4. The photovoltaic device of claim 1, wherein said p-doped diamond layer is microcrystalline diamond having a thickness in the range of from about 1 micron to about 5 microns.

5. The photovoltaic device of claim 1, wherein said p-doped diamond is doped with a material having a stable valence state less than four.

6. The photovoltaic device of claim 5, wherein said p-doped diamond is microcrystalline diamond doped with one or more of B, Al, Ga or In.

7. The photovoltaic device of claim 6, wherein said p-doped diamond is microcrystalline diamond doped with B.

8. The photovoltaic device of claim 1, wherein said n-doped ultrananocrystalline diamond is doped with a material having a stable valence state greater than four.

9. The photovoltaic device of claim 1, wherein said n-doped ultrananocrystalline diamond has average grain size in the range of from about 3 nanometers to about 15 nanometers.

10. The photovoltaic device of claim 9, wherein said n-doped ultrananocrystalline diamond has average grain size of less than about 10 nanometers.

11. The photovoltaic device of claim 1, wherein said n-doped ultrananocrystalline diamond is doped with one or more of N, P, Sb or S.

12. The photovoltaic device of claim 1, wherein said n-doped ultrananocrystalline diamond is doped with N.

13. The photovoltaic device of claim 1, wherein said n-doped ultrananocrystalline diamond layer has not less than 10^{19} atom/cm^2 nitrogen with an electrical conductivity at ambient temperature of not less than about 0.1 $(\Omega\ cm)^{-1}$.

14. The photovoltaic device of claim 13, wherein said n-doped ultrananocrystalline diamond has grain boundaries that are about 0.2 to about 2.0 nm wide.

15. The photovoltaic device of claim 1, wherein said n-doped ultrananocrystalline diamond layer has a thickness in the range of from about 1 micron to about 5 microns.

16. A photovoltaic device, comprising a layer of p-doped microcrystalline diamond, a layer of n-doped ultrananocrystalline diamond deposited on said layer of p-doped microcrystalline diamond, irradiation of said n-doped ultrananocrystalline diamond layer producing electron flow there between, and electrodes connected to each layer.

17. The photovoltaic device of claim 16, wherein said p-doped diamond is microcrystalline diamond with average grain size in the range of from about 1 micron to about 10 microns.

18. The photovoltaic device of claim 17, wherein said p-doped diamond layer is microcrystalline diamond having a thickness in the range of from about 1 micron to about 5 microns.

19. The photovoltaic device of claim 18, wherein said p-doped diamond is microcrystalline diamond doped with one or more of B, Al, Ga or In.

20. The photovoltaic device of claim 19, wherein said p-doped diamond is microcrystalline diamond doped with B.

21. The photovoltaic device of claim 19, wherein said n-doped ultrananocrystalline diamond is doped with one or more of N, As, Sb or S.

22. The photovoltaic device of claim 21, wherein said n-doped ultrananocrystalline diamond has average grain size up to about 15 nanometers.

23. The photovoltaic device of claim 22, wherein said n-doped ultrananocrystalline diamond has average grain size of less than about 10 nanometers.

24. The photovoltaic device of claim 23, wherein said n-doped ultrananocrystalline diamond layer has a thickness in the range of from about 1

micron to about 5 microns.

25. The photovoltaic device of claim 24, wherein said n-doped ultrananocrystalline diamond layer has not less than 10^{19} atom/cm^2 nitrogen with an electrical conductivity at ambient temperature of not less than about 0.1 $(\Omega\ cm)^{-1}$.

26. The photovoltaic device of claim 25, wherein said n-doped ultrananocrystalline diamond has grain boundaries that are about 0.2 to about 2.0 nm wide.

27. A method of producing a photovoltaic device, comprising providing a substrate in a chamber, providing a first atmosphere containing about 1% by volume CH_4 and about 99% by volume H_2 with dopant quantities of a boron compound,

subjecting the atmosphere to microwave energy to deposit a p-doped microcrystalline diamond layer on the substrate, providing a second atmosphere of about 1% by volume CH_4 and about 89% by volume Ar and about 10% by volume N_2, subjecting the second atmosphere to microwave energy to deposit a n-doped ultrananocrystalline diamond layer on the p-doped microcrystalline diamond layer, and providing leads to conduct electrical energy when the layers are irradiated.

28. The method of claim 27, wherein the substrate is transparent to solar light.

29. The method of claim 28, wherein the n-doped nanocrystalline layer is not less than about 10^{19} atom/cm^2 nitrogen with an electrical conductivity at ambient temperature greater than about 0.1 $(\Omega\ cm)^{-1}$.

30. The method of claim 29, wherein said n-doped ultrananocrystalline diamond has grain boundaries that are about 0.2 to about 2.0 nm wide.

31. The method of claim 30, wherein the n-doped ultrananocrystalline diamond layer is grown on the transparent substrate maintained at a temperature not less than about 350°C during the deposition process.

32. The method of claim 31, wherein the source of carbon is one or more of CH_4 or a precursor thereof and C_2H_2 or a precursor thereof and a C_{60} compound.

33. The method of claim 32, wherein the atomic percent of carbon in the second atmosphere is about 1% and the nitrogen is present in an amount less than about 10% by volume and the balance being a noble gas.

34. The method of claim 33, wherein the n-doped ultrananocrystalline diamond is grown on the transparent substrate maintained at a temperature in the range of from about 350 to about 800° at total pressures of not less than about 100 torr.